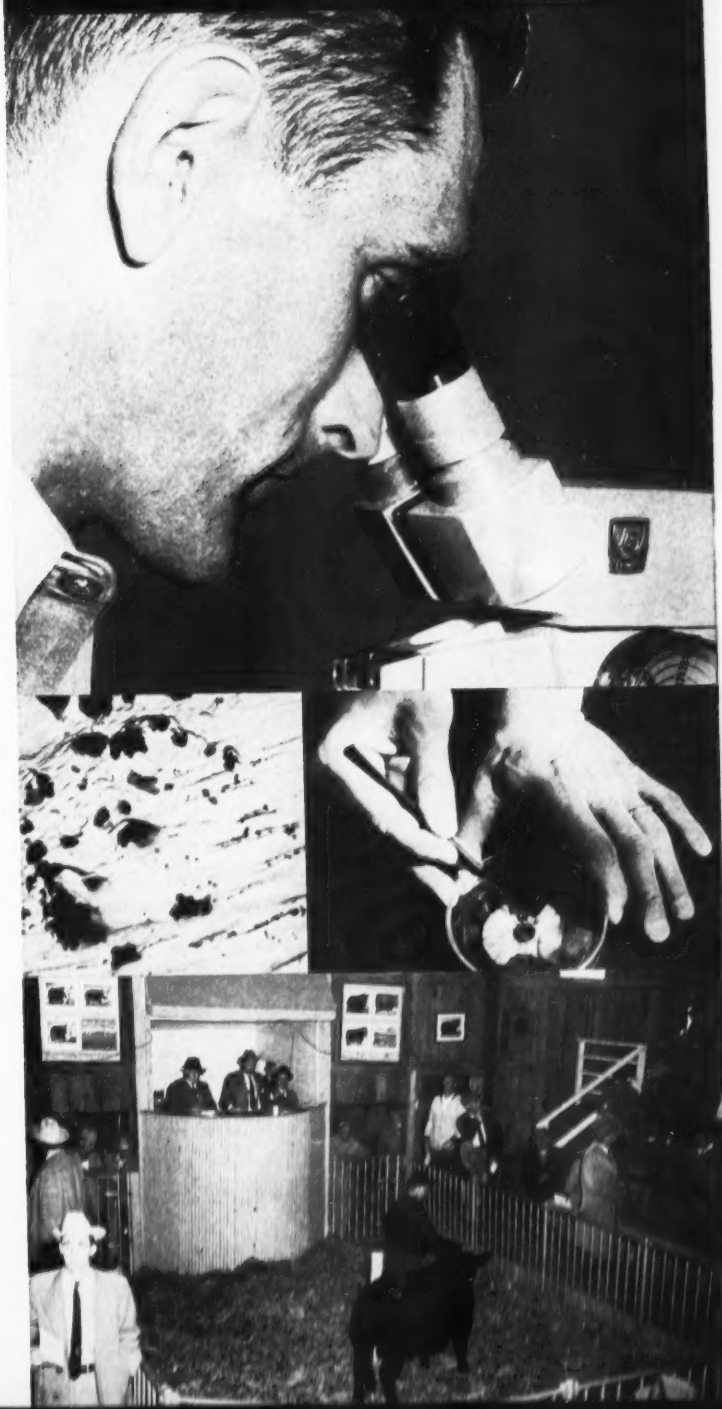
AGRICULTURAL Research



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Research

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Future

We're all familiar with the achievements of United States agriculture over the last few decades—how a farm population decreasing by nearly a third has increased farm output by two-fifths since 1940, how net farm income for the country as a whole has more than doubled since the 1937–41 years. Farmers have enlarged their farms, further mechanized their operations, improved their practices, and adopted modern technology.

Yes, the past is remarkable. What about the future?

The long-range opportunities for farming look favorable.

Readjustments will be necessary, of course. It looks as though we may be struggling with overabundance for a decade ahead. We were producing in 1957 at an annual rate about equal to what we may be needing 4 or 5 years from now.

Looking further ahead, however, we see the possibility of needing 35 to 45 percent more farm output (above 1957 levels) to meet projected demand in 1975. It's estimated that we'll have 230 million people to feed in this country by that time. And urban development will bid for farmland and labor.

Indications are that we will be able to meet the expanding need for food and fiber. But to do that, we must look for still greater improvements in production efficiency. Present research suggests that we are going to find these improvements. This will reduce a farmer's risk, improve his opportunities, and make him less vulnerable on price declines.

The most important possibilities seem to lie in raising the output per acre and animal. Learning how to utilize our foods better and preventing crop losses before and after harvest offer still other worthwhile possibilities.

Economists tell us farms will become larger and more efficient. Farmers will buy more and more of their production factors and become more specialized. Cash outlays will increase.

We have some backlog of known research results that can be applied to increase output whenever it proves profitable. But continued increases in production efficiency depend largely on a vigorous, imaginative research effort involving both basic and applied investigations. Only with such support will we be able to supply added production as the needs arise.

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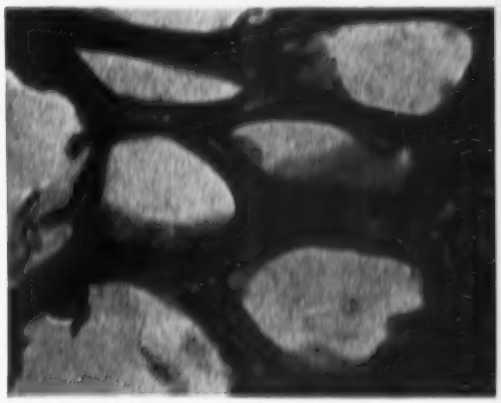
AGRICULTURAL RESEARCH SERVIC
United States Department of Agricultur

MYCORRHIZAE formations on slash-pine seedlings are examined by plant pathologist J. G. Palmer, working in greenhouse at Agricultural Research Center, Beltsville, Md.

ROOTS of the pine, removed from the soil, reveal fungi covering entire sections. Formations help seedling to grow much more rapidly.



THREADLIKE filaments of ectotrophic fungus, used for experiments, penetrate between the cells, and radiate into a large volume of the soil. Endotrophic fungi, on the other hand, penetrate inside the cells of the seedling roots.

FINDING FUNGI THAT HELP TREES

We're looking for the most beneficial organisms and for ways to inoculate the soil

■ MANY ORGANISMS hinder plant growth, but some formations, such as mycorrhizae, directly benefit growth.

Mycorrhizae are formations of fungi and roots. The fungi penetrate the roots of trees and shrubs and help trees absorb the nutrients from the soil. Trees will grow, of course, if climatic and soil conditions permit, but growth will be better in the more infertile soils when natural development of mycorrhizae is best.

USDA plant physiologist Edward Hacskaylo and plant pathologist J. G. Palmer want to find which mycorrhizal fungi are most beneficial to tree growth. There are two kinds:

1. Ectotrophic fungi (AGR. RES., March 1956, p. 6) have threadlike filaments that form covers around the roots, penetrate *between* the cells, and radiate into a large volume of the soil. This enables the trees to obtain an increased amount of the nutrients that are available in the root zone.

2. Endotrophic fungi have filaments that penetrate *inside* root cells. The roots digest the fungus and absorb it as additional nutrients.

The ARS researchers set out to establish tree seedlings and inoculate them with different kinds of fungi to determine which are the most efficient. But first, it was necessary to find a method of removing all mycorrhizal fungi from the soil so that controlled pure culture inoculations would be insured for the experiments.

Treatment stops formation

Studying the effects of a variety of chemicals on ectotrophic mycorrhizae, scientists recently learned that pretreatment of the soil with methyl bromide at 1 pound per 25 square feet prevents formation of mycorrhizae on Virginia and slash pines during the first growing season.

Chemical increases growth

Methyl bromide also resulted in increased growth of seedlings. They were planted after fumigation, since the chemical is poisonous to living plants. Reduction of other organisms in the soil probably reduced competition for nutrients, enabling the seedlings to grow faster.

Increased growth of the plots treated with methyl bromide continued during the second growing season, but mycorrhizae appeared on the seedlings. Possibly residual filaments or spores in the soil, or airborne spores of mycorrhizal fungi, or both served as inoculum for the plots.

Since soil becomes repopulated naturally by uncontrolled mycorrhizal fungi by the second season,

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SPORES of *Amanita muscaria* fungi come from mushrooms growing near some of trees. These spores will be scraped from the dish and used for inoculation experiments.

future studies with specific forms will be undertaken through controlled inoculations during the first season. At this time, other fungi are absent, or present in only small numbers.

Inoculation method sought

Researchers are now looking for the best method of inoculating soil. They are experimenting in the laboratory with organisms on grains. If organisms grow successfully on the grains, they will be sown. Still another method of inoculation under study is use of fungus spores from mushrooms growing around the trees.

If inoculations are successful, and the best organisms can be traced, then the problem of transplanting them to areas where they may become established to aid trees will have to be solved. The effect of different mycorrhizal fungi on other species of trees will also be given careful study. ☆

CAN PLANT NUTRITION AFFECT INSECT CONTROL?

Pests seem harder or easier to kill, depending on fertilizer diet of the host crop

■ When plants are supplied with amounts of nitrogen, phosphorus, or potassium providing good growth, spider mites feeding on these plants are easier to kill with malathion.

Mites also are easier to kill when feeding on plants that have received a low level of phosphorus.

But mites are more difficult to kill when too much or not enough nitrogen or potassium nutrient is applied.

This is the result of preliminary experiments conducted at USDA's Agricultural Research Center, Beltsville, Md., with two-spotted spider mites on pole-lima beans. This may mean insect and mite control could be easier or more difficult depending upon the nutrition of the plants.

Uses of findings suggested

Possible applications of this information might be made in regulating the kind and amount of fertilizer to use for maximum effect on insects and mites, as well as for a maximum crop. Difference in susceptibility under various nutrient levels may possibly explain reported resistance to insecticides in insects and mites. Perhaps control practices could be timed to take advantage of the seasonal variations in the level of nutrients in the tissues of the plant.

ARS entomologist Thomas Henneberry is in charge of the experiments, being conducted in cooperation with plant physiologist N. W. Stuart.

Workers study interactions

Nutrient solutions are applied to the bean plants the first day after potting, and twice a week thereafter. Different levels of nitrogen, phosphorus, and potassium are being tried independently and together.

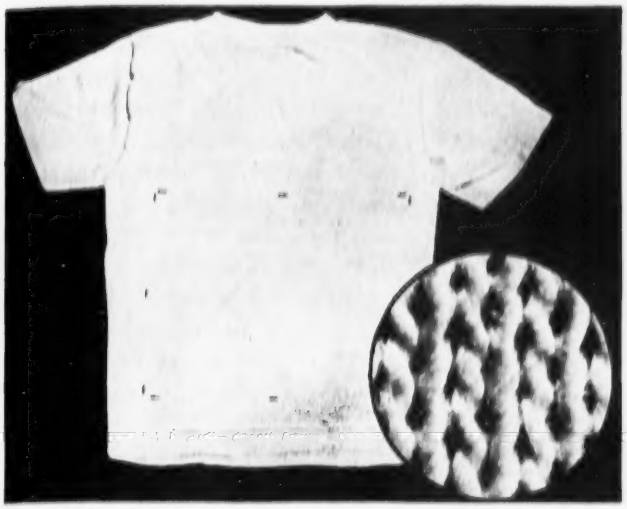
With high levels of phosphorus and all levels of nitrogen, irrespective of the potassium levels, the mites are harder to kill. With high levels of potassium and high levels of nitrogen, irrespective of the phosphorus levels, the mites are likewise harder to kill. These and other interactions require further study for full understanding.

Researchers are also carrying out investigations in which mite susceptibility will be measured in relation to plant-growth variation produced by temperature and light treatment. ☆

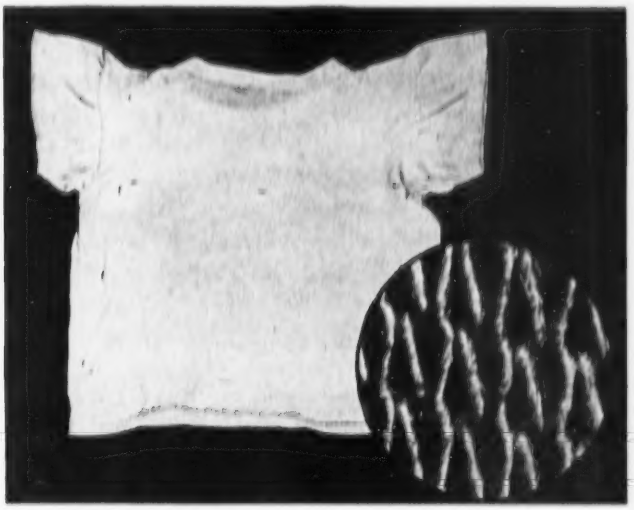
NUMBER of mites on leaves from each plant is tabulated by entomologist Henneberry to determine different survival counts of mites on pole-lima beans fed different diets.

MITES are easier to kill with malathion on healthy plants (left) fed enough nitrogen for good growth. But mites are harder to kill on plants (right) supplied no nitrogen.

Will a T-shirt Keep Its Shape?



ROUND LOOPS before washing (inset) show relaxed fabric. Shirt retains shape after 20 launderings, tumbler dryings. (Ink marks enclose area originally 10 inches square.)



ELONGATED LOOPS before washing (inset) indicate shirt will widen, shorten (note ink marks). Sleeves and neckband, cut crosswise on fabric, ruffled from excessive stretching.

The shape of the loops, or stitches, tells whether the garment will shrink or stretch

■ CAN A PURCHASER TELL whether T-shirts or other plain knit cotton garments will keep shape after laundering?

Research in the USDA Institute of Home Economics provides a key. It lies in the geometry of the knit. That is, a garment will have stable dimensions if the fabric loops (stitches) are round or slightly wider than long and there are more courses (loops counted lengthwise) per inch than wales (loops counted crosswise) per inch.

Stitches are pulled lengthwise during knitting. Round loops in a garment indicate these stitches have already been relaxed to natural shape and there will be little further change in dimension. If the loops are still elongated, however, they will relax during laundering, and the fabric will become wider and shorter.

These findings confirm earlier USDA studies (AGR. RES., November 1953, p. 13; May 1957, p. 11). These showed that stretching and shrinking during laundering were caused largely by changes in loop shape, whether the fabric was tricot or plain knit, or whether it was made of cotton, rayon, acetate, or nylon fiber.

ARS textile physicists S. H. Roberts and H. M. Fletcher included shirts of 33 different brands in the recent study. These included many sizes of yarn and loops of various width-to-length ratios. The researchers marked the shirts with three 10-inch distances in each direction and counted the wales and courses per inch between these markings. After each washing the distances between markings were measured; after five washings the wales and courses were counted. Differences in measurements and wale and course counts between washed and unwashed shirts showed the effect laundering had on the garments.

Shirts with loops having a width-to-length ratio of less than 1.0 before laundering shrank a great deal in length when washed and many stretched excessively in width. Garments with a ratio greater than 1.0 before laundering retained their shape and shrank only about 6 percent in both length and width when dried flat on a screen. After laundering, the width-to-length ratio of loops in all the garments approximated 1.2. Drying in a tumbler drier increased the amount of shrinkage in the garment. ☆

Tougher Coating from TUNG OIL

Greater serviceability and resistance to fungus damage have been built into new varnish

■ RESULTS OF RECENT research in tung oil show great promise in paints and varnishes with hoped-for properties such as greater toughness and resistance to water, alkali and mildew.

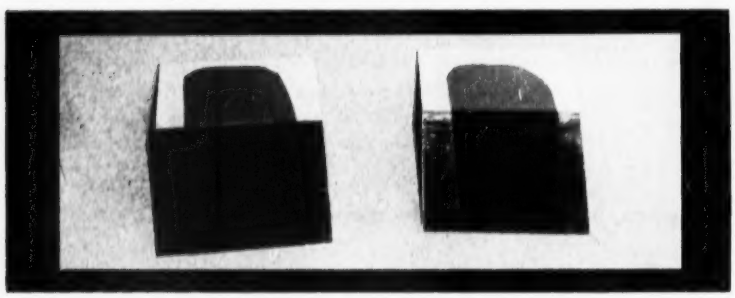
Tung oil, because of its rapid-drying properties, has long been of interest to the paint and varnish industry. But the highly reactive character of the oil requires different techniques than those used with soybean, linseed, and other drying oils.

Important exploratory work has been done during the past 3 years by L. L. Hopper, Jr., fellow of the Tung Research and Development League, and chemist L. A. Goldblatt at USDA's Southern Utilization Research and Development Division, New Orleans.

Many modern protective coatings are made with alkyd resins, or synthetic oils, usually a combination of a polyfunctional alcohol and acid. Recently, an alkyd in which all the drying oil is tung oil, was prepared on a pilot-plant scale for a drum-coating enamel. It is now being evaluated by a major manufacturer.

Epoxy resins seemed to hold even more promise than the alkyds. These are synthetic resins obtained by the condensation of phenol, acetone, and epichlorohydrin. However, technical literature indicated it was difficult or even impossible to prepare epoxy resin esters with tung oil.

This served as a challenge, for formulations with epoxy resins offer extremely good adhesions, toughness, chemical resistance, and production



BAKED ENAMEL made with tung oil shows its toughness by bending sharply without cracking (right), whereas standard enamel on other metal strip cracked under stress.

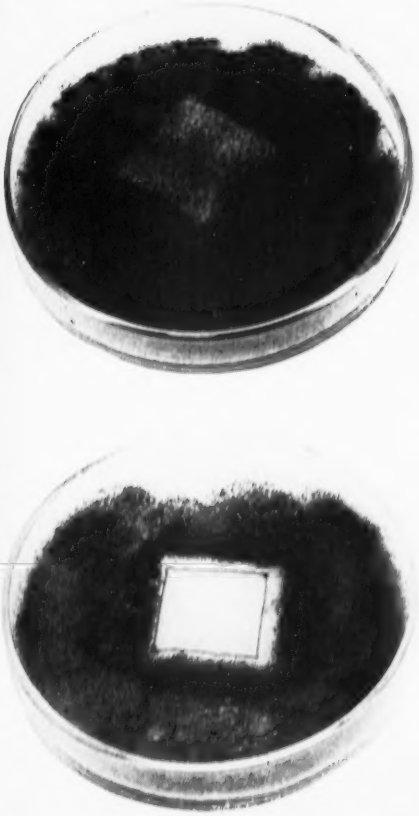
FUNGUS CULTURES are prepared for test on varnishes. Some wooden blocks were coated with ordinary varnish, others with experimental varnish made with tung oil and fungicide. Microbiologist Ruth Y. Mayne inoculated specimens with fungi and will incubate them to see whether fungi can grow on the varnishes.

TEST BLOCKS have been kept for 7 to 10 days in a warm, moist chamber under conditions that frequently cause varnishes to become moldy. Inspection will show whether experimental varnish can withstand fungi.

of a hard, glossy film. Satisfactory results were finally obtained through the use of zinc resinate as a catalyst for the ester exchange. The zinc resinate also served to improve the water and alkali resistance of the finished coating. This is of great significance for many uses—for example, as finishes for washing machines.

Still another development is the inclusion of long-term, built-in fungicidal properties. Tung oil actually has excessive drying power while various fungicidal compounds that might be used are essentially nondrying. The scientists successfully combined these two characteristics and developed a potential fungicide coating which is now being evaluated. Extensive evaluation work on this and other new coatings is being planned in cooperation with industry. ☆

GRAPHIC EVIDENCE of effectiveness of fungicide in tung-oil varnish is shown here. Top square was coated with ordinary varnish, bottom square with fungicidal varnish.



The Role of FAT in Nutrition

■ THE COMPLICATED CONTRIBUTION of fat in nutrition is just beginning to be recognized and many researchers are working on various aspects. The USDA Institute of Home Economics is among those conducting research to find out the amounts and kinds of fats required for optimum health. ARS researcher Ruth M. Leverton sums up our present knowledge about the need for fat and the part played by linoleic acid as follows:

Fats are an important kind of food for all of us. They add variety and flavor to many foods, are concentrated sources of energy, carry vitamins A and D, and supply fatty acids that are essential for growth and health. Also, fats spare protein so that it is available for its specialized functions. Fat tissue in the body is important for support, protection, and insulation of vital organs and areas. In other words, fat is a *normal constituent* of food. And the body's use of fat for fuel is a *normal process.*

Linoleic acid is of particular importance. It is an essential unsaturated fatty acid and part of many fat molecules. It is needed for such vital functions as keeping the skin healthy.

Because the body cannot manufacture it, linoleic acid must be supplied in foods we eat. Common foods that contain appreciable amounts are the natural oils from corn, cottonseed, and soybean. Peanut oil and poultry fat have less linoleic acid, olive oil and pork fat still less. The fats of beef, lamb, milk, veal, and cocoanut oil contain very little linoleic acid. Margarines and shortenings differ widely in linoleic-acid content, depending on raw materials used and extent to which they are hydrogenated.

There is some evidence that fats with a high content of linoleic acid may help to lower blood cholesterol levels. Cholesterol is synthesized in the body and is a normal constituent of blood. There have been some indications that a high level of cholesterol is associated with atherosclerosis—a type of arteriosclerosis in which fatty material is deposited along the inner lining of artery walls. However, we lack evidence at this time that lowering blood cholesterol reduces the occurrence of atherosclerosis.

To most of the questions being asked on fat requirements and metabolism, the effect of different processing procedures on the nutritive value of fats, and the relation of fat to heart disease, we must answer that we do not know. But much research is in progress, and the practical results of these investigations will be applied as soon as possible to improve the Nation's food and its health. ☆

HOW COTTON SOILS

Findings are helping scientists move ahead in search for effective soil-resistant finishes

■ WE HAVEN'T YET come up with a cotton that *completely* repels soil, but we have come a long way in finding out exactly how and why cotton *does* soil and what can be done about it.

Present work at USDA's Southern Utilization Research and Development Division, New Orleans, is aimed at improving cotton's qualities, with much effort going into improvement of resistance to dry soiling.

It's necessary to understand the mechanism of dry soiling before really effective soil-resistant finishes can be developed. Development of such hard-to-soil cottons would mean longer life and lower upkeep costs, especially for hard-to-launder drapes and upholstery fabrics.

Gray and chemically modified cottons were artificially soiled in controlled tests with colloidal and activated carbon, floor soil, and a synthetic soil and clay. Soiled cottons were examined by oblique lighting and in an electron microscope.

Fabric spaces hold the soil

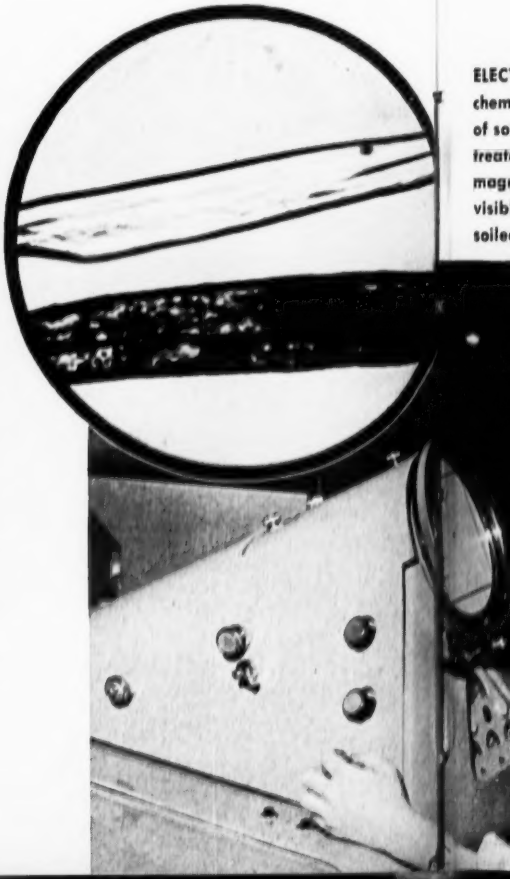
The geometry of the fabric—the way the fibers are physically put together—plays a major role in determining the distribution of the soil. The soil particles are mechanically and unevenly trapped between the fibers near the surface of the fabric and on the fiber surface because of the natural irregularities, grooves, and ridges of many cottons.

ARS chemists V. W. Tripp and Anna T. Moore, optic physicist Blanche R. Porter, and physical scientist Mary L. Rollins found a wide range in the pickup of soil by cottons treated with typical finishing agents.

The hard, fine "particulate" finishes, for instance, greatly improved the soil resistance of the cotton. These granular finishes—which impart a colorless, sandpaper-like coating to the fibers—probably act by filling in the potential sites of soil attachment so soil particles can't get in. Examples of these finishes are colloidal silica and alumina, applied to the surface of the fabric from water suspensions. Another finish—perfluorodecanoic acid—gave significant resistance to soiling without changing the fiber surface.

Fabrics that were treated with a soft resin (like acrylic polymer latex emulsion) soiled easily and quickly. Soil particles got into the soft coating

OBLIQUE LIGHTING *clearly reveals the pattern of soil entrapment between fibers of soiled, untreated bleached fabric. Low magnification was used with this method.*



easily and embedded themselves firmly, a fact perhaps noted by persons who wear resin-treated fabrics.

The extent of the soiling apparently depends upon how soil gets into a fabric and how it is held there.

Fiber folds also trap dirt

The natural irregularities of the fiber surface—folds or wrinkles, grooves, and ridges—serve to trap and imprison the dirt. These irregularities persist through routine chemical modifications such as mercerization—treatment with caustic alkali to make cottons stronger, silkier, easier to dye. Irregularities also persist through newer and more specialized modifications such as partial acetylation and cyanoethylation, resin impregnation, and some types of additive finishing (AGR. RES., October 1957, p. 15; June 1957, p. 15; October 1955, p. 16). And the more dirt in a spot, the more will collect on top of it. Size of soil particles helps determine the extent of soiling, too. Finer particles get into the fiber surface deeper than large particles ordinarily do.

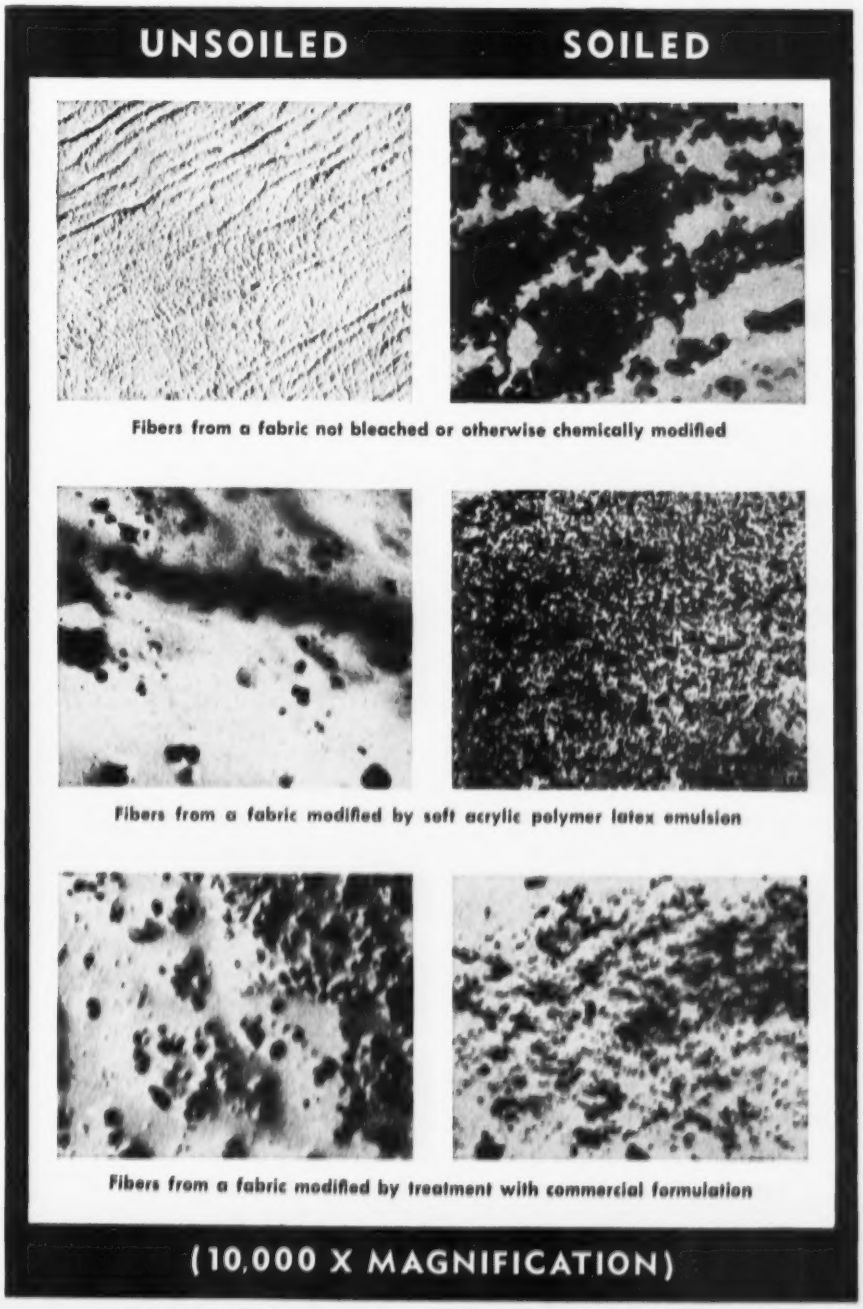
Researchers found that dirt also attaches to smooth, regular fiber surfaces. This shows that soil adsorption is due to chemical attraction as well as mechanical entrapment.

Chemical treatment best hope

Modifications of the fiber surface through scouring (which gets rid of cotton's noncellulosic coating) or by carboxymethylation (which roughens the surface) have little effect on the distribution of soil on the fiber.

The best present antisoiling agents are additive finishes or chemical modifications that tend to lower the energy of the fiber surface. Perhaps really effective soil resistance can be built into future cotton by combinations of various treatments. Much work remains to be done, however, on surface-energy effects in soiling of cotton, and on adaption of modifications for commercial use. ☆

ELECTRON microscope is utilized by chemist Anna T. Moore to examine location of soiling agents in fibers from chemically treated and untreated fabrics. Microscope magnifies greatly, hence greater detail is visible. Circular inset shows unsoiled and soiled fibers at 500 × magnification.



Look for Gains Through ROP

Virginia's research-based improvement effort pays off in more efficient beef production

■ VIRGINIA'S BEEF CATTLE have earned a solid reputation for predictability and excellence, thanks to USDA-State research and marketing procedures.

Current improvement in the State's cattle is being made through a statewide record-of-performance (ROP) testing program by the recently organized Virginia Beef Cattle Improvement Association. Its work is based almost entirely on research results from several years of beef testing at the Beef Cattle Research Station, Front Royal, Va. (AGR. RES., April 1955, p. 3).

Researchers there have found that a bull's early performance record is useful in predicting similar performance (rate of gain, conformation to good carcass type, and feed-use efficiency) in his offspring. No longer need a breeder wait until a bull is 2 or 3 years old before finding out his potential value as a future herd sire.

Good showing spurred breeders to organize

Limited testing in Virginia and elsewhere confirmed the practicability of judging a bull's breeding potential by calfhood tests. Virginia Agricultural Experiment Station researchers, the Virginia Division of Markets, and breeders realized the importance for herd improvement of recognizing outstanding bulls early. So in 1955 they organized State breeders for ROP testing of beef cattle. This was the first such statewide plan. Similar groups have since been started in a number of other States.

What *is* performance testing and how does it operate?

It's the evaluation of inherited differences in ability to grow rapidly, to mature early, to use feed efficiently, and to develop the desired type of carcass. It's done by measuring gain before and after weaning, feed requirements per pound of gain, and grade (or type desirability). Confidential data are provided to association members on *all* progeny of each bull and cow in member herds.

Professional and record services are given

When a breeder joins the association—which he can do if he has 25 or more purebred or grade cows—he gets a code number for his herd and an IBM card for each cow. When a cow calves, the breeder gives the calf a number to identify it, records the number, the calf's sex, birth date, and weight, and the identification number of its sire and dam. He mails a card on each calf to the State supervisor in Blacksburg. Just before weaning time a team visits the farm to weigh and grade his cattle.

Breeders get from the State office the performance record of each calf, showing age, weight, type score, average daily gain, and index value. All calves by one sire are grouped and their average performance shown. At the end of the year, each breeder gets a performance record of the progeny of all organization sires.

Thus, a breeder can better evaluate the worth of each animal in his herd. He can compare gains and type scores

CALF in upper left picture will soon tell through performance tests not only his own intrinsic worth as a herd sire but also, in part, the value of his dam as a breeder. Value of such testing is shown by bulls in corner picture. They may appear similar, but weanling calves of bull at left were worth $12 per head more than other bull's calves. Weighing and grading—important part of ROP testing—are done on farm (below) when animals are 4 to 10 months old. Virginia association frequently provides portable scales.

BRISK BIDDING by livestockmen and fast sale of bulls at recent Front Royal auction is indication of value of ROP-tested cattle. Bulls were bought with confidence by beef breeders anxious to improve herds. Animals brought good prices.

of calves sired by different bulls. He can compare the performance of all cows in his herd. He can see how his herd compares with other association herds in his State.

Records point out best animals in herd

This information enables a breeder to decide which bull is doing the best job of improvement, which cows are producing the best calves. It provides a guide for culling the herd and for deciding which heifers to save for herd replacements. Such detailed information plus the breeder's personal knowledge of his cattle are the best basis for improving growth rate and conformation.

There are about 150 herds in the Virginia Beef Cattle Improvement Association. There's a membership fee and a small weighing and grading charge. But these are more than offset by greater returns from the cattle.

Researchers, as well as herd owners, believe performance testing of beef cattle is here to stay—improving efficiency of beef production, and giving the consumer a better meat product at a somewhat lower cost. ☆

PREMIUMS of $25 per head were paid by Dunbar Oswald (right in above picture) for 100 ROP cattle to stock a South Carolina farm. Beside him, Thomas Marlowe, executive secretary of Virginia Beef Cattle Improvement Association, negotiates the sale with seller Prescott Carter. At right, association-tested cattle at recent Front Royal auction are discussed by State-Federal researchers (l. to r.): Kenneth Bovard, Marlowe, Charles Kincaid, George Litton, and Everett Warwick.

Saving Ranch MINKS

CAGED, ranch-raised mink are especially susceptible to new disease. It spreads easily from pen to pen and kills the kits rapidly. Adults survive.

■ WESTERN RANCH-RAISED MINKS face the threat of extinction from virus enteritis if the disease continues to run its present course, say USDA researchers. Virus enteritis is a deadly intestinal disease that usually kills affected animals. There has been a recent sharp rise in outbreaks of the disease in Wisconsin, Michigan, New York, Illinois, and Massachusetts.

There's no way to treat infected animals. But growers and veterinarians can take measures to prevent or check the disease, according to ARS veterinarians D. Burger, R. K. Farrell, and J. R. Gorham, who are stationed at the Washington Agricultural Experiment Station, Pullman.

Two types of vaccine are available. Perhaps the most effective is one prepared from spleens of animals dead of the disease. The other is a commercial vaccine used against feline panleucopenia—blood disease of cats. Although this vaccine isn't specific for virus enteritis, it does give beneficial results. First dose of preventive vaccines should be given about the last week of June followed by a second dose administered 10 days later.

Virus enteritis in minks occurs mostly in July, August, and September, and even up to pelting time. June outbreaks, fortunately uncommon, are quite difficult to control. Kits are most susceptible; adults are fairly resistant and seldom die.

The disease may reappear each summer on one ranch. Losses of half the kits are common. Exact mode of spread is unknown. Carrier minks and maybe cats may bring the disease to a clean ranch. Birds and insects may carry the disease, too. The disease pattern is similar to distemper. It spreads easily to nearby pens, but new cases may be noticed many yards away from known infected pens.

First sign of the disease is refusal of infected animals to eat. At autopsy, these animals show marked inflammation of the intestines. The lining is swollen and cells are deteriorated. The spleen is enlarged and dark and may show signs of hemorrhaging. Lungs and liver look normal. ☆

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WE'RE PRODUCING MORE SILAGE

■ SILAGE PRODUCTION KEEPS GROWING, and harvesting methods keep improving. Horsedrawn cutting sleds were used when silage was first reported, on a small scale, in this country in 1875. But field choppers have harvested over 80 percent of the silage in recent years.

A USDA survey indicates that about one-eighth of our farms used silage in 1955. The study, conducted by ARS and Agricultural Marketing Service on 29,000 farms, shows an increase in silage making and in number of farms using silage. This trend is pronounced everywhere except in the Lake and Northeastern States.

Production in 1955 ran 73 million tons—one-third more than in 1951. The 600,000 farms making silage in 1955 represent a 20-percent increase in 5 years.

The study, which includes corn, grass, sorghum, and other silage, shows greatest use where dairying is important. Corn accounted for 74 percent of all silage. Tower silos stored 70 percent of the corn silage, with the balance in trench, bunker, and temporary silos.

Grass silage, totaling 9.3 million tons for the United States, was made from hay crops, small grains and pasture clippings. The main crops used were alfalfa, clover, soybean, cowpeas, vetch, and sudan grass.

About one-third of the grass silage was treated with a preservative. Sodium metabisulfite was used as the only preservative on about 45 percent of these farms. Molasses preservative was used alone on 23 percent.

Sorghum silage totaled 9.4 million tons, with the bulk in Kansas, Texas, Missouri, and Oklahoma. Drought-resistant qualities make sorghum a leading silage crop in much of the southern and central plains area.

"Other silage" (byproducts of canning and processing crops, and other products) totaled 1,160,000 tons and was most important in Northeastern and Pacific States.

Mechanical unloaders were used for removing only 4 percent of all kinds of silage that was stored in tower silos in 1955. Six percent of the trench and temporary silos were constructed to allow self-feeding. ☆

Regardless of this cow's activity on pasture the gases she exhales are measured and sampled by a device that's helping us learn more about

A COW'S USE OF ENERGY

■ A PORTABLE METER has been strapped to a cow's back to measure her exhalations. USDA scientists are using the information to find how much energy a cow uses on pasture.

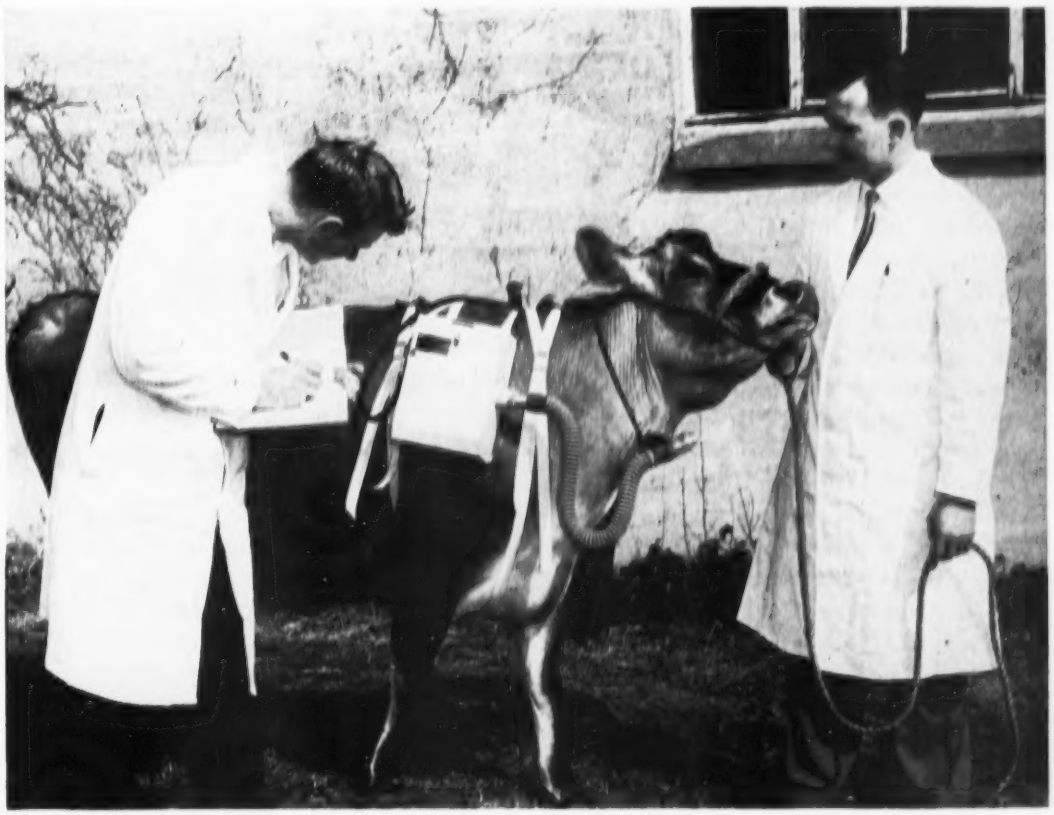
D. R. Waldo, ARS dairy husbandman, is conducting the experiment at the Agricultural Research Center, Beltsville, Md. He wants to find out why a cow uses more energy to maintain her body in a pasture than in a barn. And he wants to find out the extent of this energy expenditure.

Two test cows roam the pastures in a natural environment. A tracheal transection has been performed so that air going in and out of each cow's lungs will pass through a plastic valve and hose. The volume of the respiratory gases the animal exhales is measured in liters on the meter. And a percentage of the gas is collected continuously in a bag harnessed to the cow. The urine and feces are also being collected in a container, which is harnessed to each of the cows while she is on pasture.

Gas samples will be analyzed to determine amount of oxygen, carbon dioxide, methane, and nitrogen. When the amount of gases animals burn and the amount of nitrogen in the urine are known, the heat production (amount of work animals do) can be computed in terms of calories.

Recordings will be made under different environmental conditions—varying in temperature, wind velocity, and sunlight. The amount of exercise the animals take will change according to the kind of pasture. If the grasses are short, the cows will obviously have to walk greater distances and take more bites than if the grasses are high. The level of food intake by the cow will be estimated to determine how heat production will vary under different conditions.

Both this pasture study to determine the amount of energy a cow uses and a study to determine the nutritional value of feed (AGR. RES., May 1958, p. 8) are part of the energy-metabolism laboratory activities. ☆



AMOUNT of gas cow exhales is indicated on dial resembling meter on gasoline pump. Bag on other side collects gas samples. Containers gather urine, feces. Two cows will roam pasture during tests. Checking equipment are D. R. Waldo (left), and W. P. Flatt, head of the energy-metabolism laboratory.

NEW MACHINE HARVESTS PRUNES EFFICIENTLY

Device eliminates stoop labor in an important crop

■ THE HIGH LABOR COST may have been taken out of harvesting prunes for drying, through cooperative research by USDA and California Agricultural Experiment Station.

Harvesting has been a major problem to prune growers, particularly in Washington, California, Oregon, and Idaho, where more than 400,000 tons of prunes are produced and dried annually. In usual practice, prunes are not picked directly from the trees. Harvesting begins as the fruit ripens and falls to the ground. Then crews are hired to pick up the prunes by hand. Occasionally, the trees are shaken to dislodge ripe prunes that have not fallen.

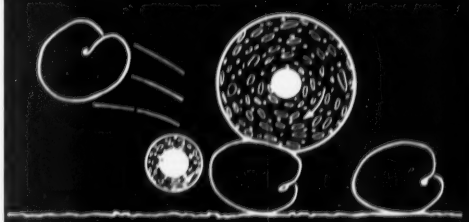
In recent trials at Davis, Calif., agricultural engineers P. A. Adrian, of ARS, and R. B. Fridley and A. A. McKillop, of the State station, have successfully tested a pilot mechanical harvester. This 1-man, self-propelled machine harvested a 20-inch swath and picked up about 1,000 pounds of prunes per hour. That replaces about four hand laborers ordinarily used.

As a result of these tests, USDA will apply for a public patent on the principle used in the machine. However, research is continuing on this and other models in an effort to develop an even more efficient harvester. The engineers hope to interest manufacturers who will produce it and place it in the hands of the growers.

The pickup device on the experimental harvester resembles the wringer of a washing machine. Two small rollers, heavily padded with sponge rubber, rotate to pass objects between them as the machine moves over the ground. The fallen fruit is pulled into the space between the rollers and tossed back onto a conveyor belt that carries the prunes to a box at the rear of the machine. For most efficient operation, the orchard floor must be level and free of stones, broken branches, and other debris.

HARVESTING MACHINE by researchers of USDA and California Agricultural Experiment Station picks up fallen prunes under trees. This displaces the costly and thankless task of picking them up by hand.

COUNTER SPIN enables the soft rolls to gently grip prunes on the ground, raise them into machine.



SOFT AUGURS in front sweep fruits toward center of swath. Pickup rolls are at height to reach but not crush fruits.

It was found that at least two runs through the orchard are necessary to pick up all the prunes in growing areas where not all the fruit on a tree matures at the same time.

For areas where a tree's entire crop does ripen at once, USDA agricultural engineers are experimenting with the use of mechanical tree shakers for removing all of the fruit. ☆

Drying rice efficiently

Raising temperature of a rice dryer and putting the rice through it more times but at a faster rate has boosted capacity of conventional equipment up to 58 percent, head yield by 2.5 percent, and total rice yield by 1.5 percent in USDA-grower studies. Drying costs were reduced, too.

A drying temperature of about 137° F., up to 6 passes through the dryer, and a drying rate of about 1,760 bags per hour proved to be about optimum in the plant-scale tests by the ARS Western Utilization Research and Development Division, Albany, Calif., and the Sutter Basin Rice Growers Cooperative at Knight's Landing, Calif. This method removed less moisture per passage through the dryer and reduced damage to the rice.

Pasture plus stilbestrol

Stilbestrol—hormone-like chemical now received by three-quarters of the beef cattle in the country's feedlots—may also help improve summer gains of yearling steers on native range, State-USDA research shows.

Yearling Hereford steers were treated with 30 milligrams of the chemical, implanted under the skin of the ear, in grazing experiments at the USDA Northern Great Plains Field Station, Mandan, N. Dak.

For the 140-day feeding test on moderately grazed pastures, implanted

steers averaged 48 pounds more per head than untreated steers. Not all of the steers in this test reacted the same to stilbestrol. Some treated animals gained less than some of the controls. But the variation wasn't great enough to offset the extra gain, averaging nearly 21 percent, made by the steers implanted with stilbestrol.

In a similar test—but on heavily grazed pastures—implanted steers kept on gaining even when some of the control animals lost weight because they couldn't get enough feed.

Although implanted steers gained much more than untreated steers on both moderately and heavily grazed pastures, the gain advantage due to having adequate feed was much greater than that due to stilbestrol.

We need to learn what effect can be expected from a second stilbestrol treatment after steers go to the feedlot for finishing. Some research suggests that stilbestrol produces greater gains only once. Many Corn Belt farmers are thus reluctant to buy feeder steers that were implanted while on pasture, fearing that further stilbestrol during drylot feeding may be ineffective. Selling price of implanted range steers might therefore be reduced enough to take the profit out of using stilbestrol to increase gains.

Control of a potato pest

The green peach aphid that attacks potatoes in the Pacific Northwest has been controlled under experimental conditions with Thiodan. Two years of USDA testing with various formulations and dosages showed Thiodan gave excellent control (90 to 99 percent) when applied by aircraft. The insecticide was found superior to demeton, Bayer 19639, trithion, thimet, malathion, guthion, American Cyanamid 4124, and parathion.

ARS entomologists working at Union Gap, Wash., used an emulsion spray made of 1 pound of Thiodan in 10 gallons of water per acre. This was superior to the same dosage prepared in kerosene, or formulated as a 60-mesh granule dust, or as a 325-mesh impregnated dust.

The insecticide killed relatively few of the larvae or adults of the coccinella, a beneficial insect that feeds on the aphids. Thiodan also controlled the tuber flea beetle and the important Colorado potato beetle.

Pioneering in nutrition

New insight into nutrition of living cells—how nutrients are used, requirements for various nutrients, and interrelationships between them—is the objective of the newly established USDA Pioneering Research Laboratory in Cellular Metabolism.

The researchers will use micro-organisms (bacteria, protozoa, algae, yeasts, and molds) as experimental tools for rapid exploratory work in nutrition. Radioisotopes will assist in following the course of nutrients as they are used by living cells. Some findings may be evaluated more specifically with animal cell cultures.

Micro-organisms are versatile tools in the investigation of a wide variety of food and nutrition problems. These living substances have so much in common with all other living organisms that learning how one species functions leads to new understanding of other species. Nutrients essential to higher animals are also essential to many micro-organisms. Many of the vitamins that function in the metabolism of micro-organisms also play essential roles in human and animal nutrition and, as far as is known, the individual vitamins perform similar enzymatic functions in all organisms.

This laboratory, part of the ARS Institute of Home Economics, will

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conduct its work at the Agricultural Research Center, Beltsville, Md. The laboratory's key scientists will include bacteriologists Howard Reynolds and Thomas P. O'Barr. These scientists have been carrying on microbiological research in the Institute of Home Economics for some time, including investigations of the thermal resistance of micro-organisms, microbiological assay procedures, and metabolic interrelationships among amino acids in micro-organisms.

New high-sugar sorgo

Release of a new early maturing sorgo adapted for production under irrigation in California's Imperial Valley and in similar western areas is announced by USDA and California Agricultural Experiment Station.

Seed for Brawley—as the new sorgo is called—will be available from the Imperial Valley Field Station at El Centro for commercial production of registered seed in 1958. No seed will be made available by USDA.

Sorgo is commonly grown for use as a sirup and a livestock feed. Brawley, however, shapes up as a potential sugar crop for California, assuming we can develop a suitable processing

technique. Brawley ranks high in sucrose content and purity of juice and compares favorably with other commercial sorgos such as Rex and Tracy in resistance to lodging.

Early maturity of the new variety makes possible two crops a year in the Imperial Valley. When so grown, Brawley was harvested earlier than Rex or Tracy, the height and total yield of the feed stalks was greater, and there was less lodging. Seed yield, however, averaged only 950 pounds per acre—about 100 pounds less than that of Rex and Tracy.

Brawley was one of the first varieties developed under a breeding program started in 1946 by USDA to produce new sorgos for culture under irrigation in the Imperial Valley. The new variety is a cross between selections from Rex, which has high lodging resistance, and from the white-seeded Collier, which has a high sucrose content, lodging resistance.

Chelates nourish fruits

Chemicals known as chelates are being used in USDA-State research to deliver essential metals to plants under soil conditions that normally cause metal starvation.

A chelate is a soluble organic compound with a ring structure that holds a metal atom between two or more other atoms. This type of linkage strongly withholds the metal atom from various soil ions that would tie up soil metals in insoluble form in an open-end type of structure.

In Louisiana, pecan rosette, a zinc-deficiency disease, was overcome by soil treatment with zinc chelate.

Where irrigation has caused an alkaline condition in California and Texas soils, lime-induced chlorosis of

citrus trees was corrected by treating the soil with iron chelates.

Soil treatment in Washington with a zinc chelate corrected chlorosis of peaches and sweet cherries. In some orchard soils, arsenic has accumulated excessively in the soil from years of spraying. Chelated zinc has overcome arsenic toxicity there.

Chelates have been successfully used as foliar sprays, too. Pear chlorosis in Oregon was overcome by spraying with chelated manganese and iron. Chlorosis of apples elsewhere in the Pacific Northwest has yielded to a summer spray of zinc chelate used in connection with spring and fall sprays of zinc sulfate.

Bagasse shipping boxes

Efficient can and bottle shipping boxes have been made from depithed sugarcane bagasse in USDA research.

Three-fourths of the bagasse boxes were equal or superior to comparable commercial boxes in laboratory compression tests, and half were equal or better in tumbler tests. Loaded bagasse boxes equaled commercial boxes in truck and rail hauls. Bagasse boxes have greater vertical stiffness but are more brittle.

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